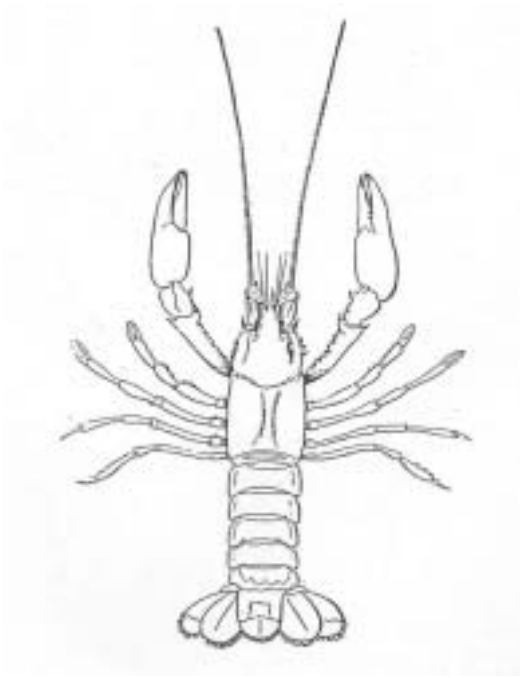
Conservation Assessment
for
Northern Cave Crayfish (Orconectes inermis)



(Packard, 1888)

USDA Forest Service, Eastern Region

October 2002

Julian J. Lewis, Ph.D.
J. Lewis & Associates, Biological Consulting
217 W. Carter Avenue
Clarksville, IN 47129
lewisbioconsult@aol.com

This Conservation Assessment was prepared to compile the published and unpublished information on Orconectes inermis. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.

Table of Contents

EXECUTUVE SUMMARY 4
NOMENCLATURE AND TAXONOMY 4
DESCRIPTION OF SPECIES 4
LIFE HISTORY 5
HABITAT 5
DISTRIBUTION AND ABUNDANCE 5
RANGEWIDE STATUS 7
POPULATION BIOLOGY AND VIABILITY 7
POTENTIAL THREATS 7
SUMMARY OF LAND OWNERSHIPAND EXISTING HABITAT PROTECTION 8
SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES 8
RESEARCH AND MONITORING 9
RECOMMENDATIONS 9
REFERENCES 9

EXECUTUVE SUMMARY

The Northern cave crayfish is designated as a Regional Forester Sensitive Species on the Hoosier National Forest in the Eastern Region of the Forest Service. The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve the species.

The Northern cave crayfish is an obligate cavernicole known from over 70 localities in southern Indiana and north-central Kentucky.

NOMENCLATURE AND TAXONOMY

Classification: Class Crustacea
Order Decapoda
Family Cambaridae

Scientific name: Orconectes inermis

Common name: Northern cave crayfish

Synonyms: Orconectes inermis inermis
Orconectes inermis testii
Astacus pellucidus
Cambarus pellucidus
Orconectes pellucidus
Cambarus pellucidus inermis
Cambarus inermis

Orconectes inermis was reported by Cope (1871) as Astacus pellucidus. The following year Cope (1872) assigned the crayfish to a new species. A redescription with a page of illustrations was provided by Hobbs and Barr (1972). The long list of synonyms reflects the confusion between the Northern cave crayfish Orconectes inermis and the Mammoth Cave crayfish Orconectes pellucidus. The name is now stable and most of the references to Orconectes inermis as other synonyms occurred in the 19th and early 20th centuries. A complete list of the synonyms and the relevant citations are in Hobbs and Barr (1972).

DESCRIPTION OF SPECIES

The Northern cave crayfish is unpigmented (white) and with eyes reduced and unpigmented. Lewis and Sollman (1998) measured and released Orconectes inermis in Binkley Cave, Harrison County, Indiana and reported the longest crayfish at 66mm. Most of the crayfish captured were between 40-60mm in length. Although examination by a specialist familiar with crayfish taxonomy is necessary for confident identification of this species, from a practical standpoint any cave crayfish found on the Hoosier National Forest can reasonably be assumed to be Orconectes inermis.

LIFE HISTORY

Banta (1907) reported that Orconectes inermis testii kept in the laboratory molted from two to five times a year, with the smaller or younger crayfish molting more often. Banta noted that very young crayfish were seen in February and March (the earliest date being February 17), but at no other time of the year. Hobbs and Barr (1972) reported that first form males (sexually mature) from throughout the year, except March and April, which were attributed to small sample size of collections during that time of the year. They noted an ovigerous female from Donaldson Cave, Lawrence County, Indiana collected in June, 1923. This specimen had 27 eggs. Jegla (1969) observed four females carrying eggs in a study in Shiloh Cave, Lawrence County, Indiana: one on June 30, two on August 16, and one on August 20. These crayfish carried an average of 45 eggs each. Hobbs (1973) found that copulation occurred during the fall and winter months and egg laying during the late summer.

HABITAT

This species is an obligate cavernicole and is typically found in cave streams, where it can be found crawling about the substrate or hiding under rocks. Although great depth is not required, Orconectes inermis is usually found in streams of depth adequate for the crayfish to remain submerged. In Wesley Chapel Gulf Cave it was noted in both the cave river and residual flood pools in an upper level passage.

DISTRIBUTION AND ABUNDANCE

Orconectes inermis inermis occurs from Hart County, Kentucky (north of, but not in, the Mammoth Cave System) northward through the southcentral Indiana karst to Monroe County, where it intergrades with Orconectes inermis testii, which occurs north into Owen County (figure 1). The subspecies found on the Hoosier National Forest is Orconectes inermis inermis.

Figure 1. *Range map of Orconectes inermis (and O. pellucidus) from Hobbs and Barr, 1972.*

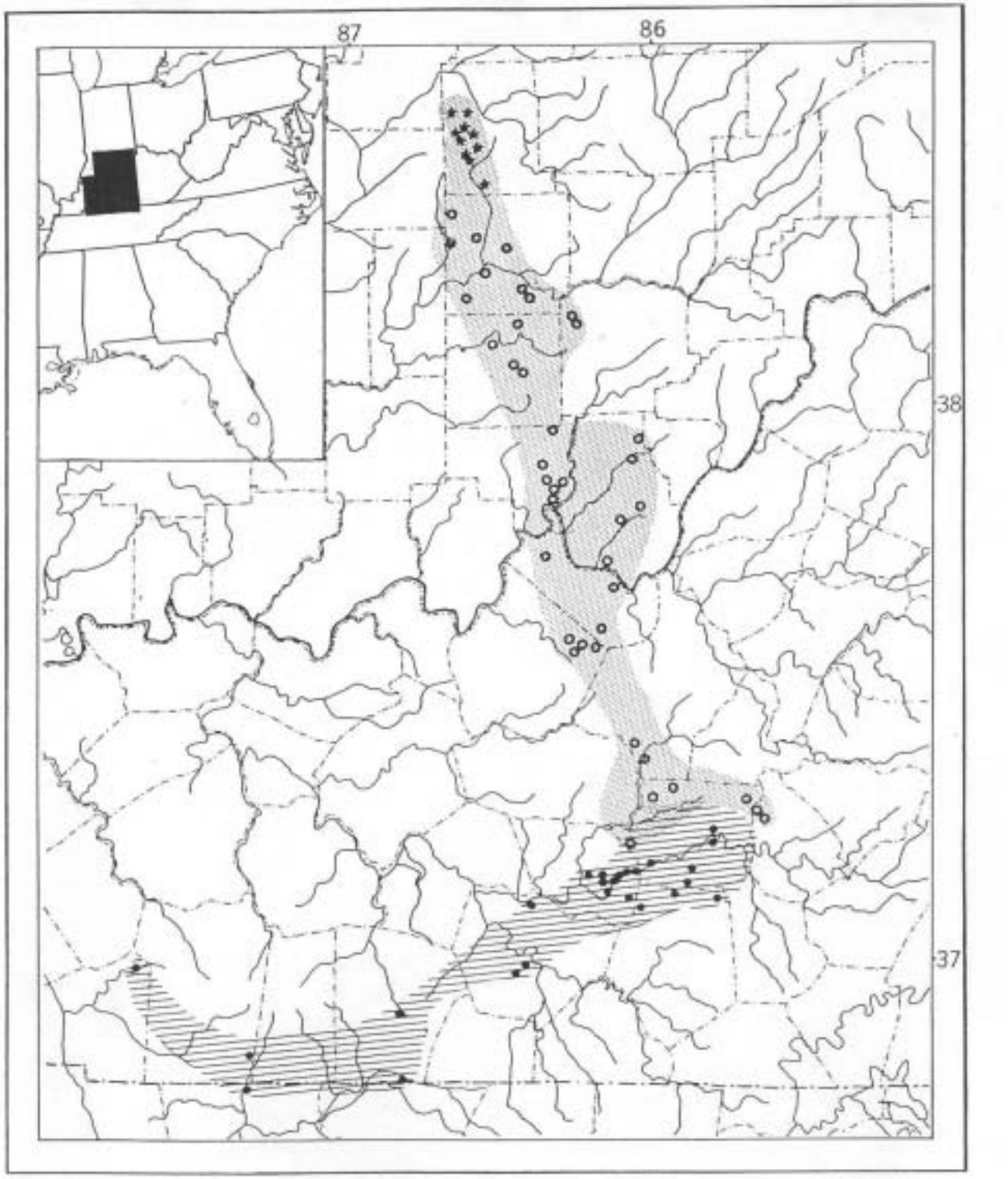


FIGURE 1.—Ranges of *Orconectes inermis inermis* and intergrades (open circles), *Orconectes inermis testii* (stars), and *Orconectes pellucidus* (closed circles).

RANGEWIDE STATUS

Global Rank: G3 vulnerable; The global rank of G3 is assigned to species that are known from between 21-100 localities. Hobbs and Barr (1972) reported Orconectes inermis from 17 caves in Kentucky and 20 caves in Indiana. This was expanded by Hobbs et al. (1977) to 71 localities (18 caves in Kentucky and 53 caves in Indiana).

Indiana State Rank: S3 vulnerable; Similarly, the state rank of S3 is assigned to species that are known from between 21-100 localities in Indiana. As noted above, Hobbs et al. (1977) reported this species from 53 localities in Indiana.

POPULATION BIOLOGY AND VIABILITY

Hobbs (1973) studied Orconectes inermis in Mayfields Cave, Monroe County, and Pless Cave, Lawrence County, Indiana. The crayfish were marked and recaptured. He found that individual crayfish remained primarily in one area of the stream, with moderate movement up and downstream. The home ranges of individuals overlapped the ranges of other individuals, potentially generating competition for food, space and mating partners. Breeding males were found to move greater distances than non-breeding males and females.

Hobbs (1973) reported that gut analysis of specimens revealed primarily plant material. Predation of crayfishes by other crayfishes was also reported. Orconectes inermis and the troglophilic species Cambarus laevis were reported to have been seen feeding on amphipods, isopods, earthworms and organic debris.

POTENTIAL THREATS

This species is vulnerable to anything that threatens the cave streams and pools the crayfish inhabit. Potential groundwater threats were discussed at length by Keith (1988).

The Wesley Chapel Gulf Cave System is particularly susceptible to groundwater contamination since it is one of the most extensive cave systems in Indiana, almost all of which lies under privately owned land. Many opportunities for fecal contamination, including septic field waste, outhouses, barnyard feedlots and grazing pastures exist in the area (Harvey and Skeleton, 1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al 1996, 1997, 1998). Chemical contamination including pesticides, herbicides and fertilizers used for crops is undoubtedly occurring, also (Keith and Poulson, 1981; Panno, et al. 1998). Some degree of hazardous material threat exists due to the potential of accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Lewis, 1993, 1996).

Cave stream habitat alteration due to sedimentation is particularly threatening in the Lost River basin due to farming, although any other kind of development that disturbs groundcover offers the same potential problems. Sedimentation changes cave habitat by blocking recharge sites or altering flow volume and velocity. Observation of the obvious

sediment load of floodwaters in Lost River attests to the magnitude of the sedimentation problem there. Furthermore, Keith (1988) reported that pesticides and other harmful compounds like PCB's can adhere to clay and silt particles and be transported via sedimentation.

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials (e.g., spent carbide, batteries) (Elliott, 1998; Peck, 1969). The construction of roads or trails near cave entrances encourages entry. However, entrance to the Wesley Chapel Gulf Cave is restricted due to the gating of two of the three entrances

SUMMARY OF LAND OWNERSHIPAND EXISTING HABITAT PROTECTION

On the Hoosier National Forest Orconectes inermis occurs in the Wesley Chapel Gulf Special Area in Elrod Cave and Wesley Chapel Gulf caves. In the Little Africa area it is found in Bond, Dillon, Duggins Spring, Little Africa Pleasure Palace and Springs Spring caves. On the periphery of the Tincher Special Area the crayfish occur in Henshaw Bend and Bugear caves. Forest service special areas are managed for the protection of the ecosystems therein (USDA Forest Service, 2000).

Elsewhere in Indiana Orconectes inermis has several relatively protected populations, including those in caves at Wyandotte Caves State Recreation Area (e.g., Wyandotte Cave, Sibert's Well Cave) and at Spring Mill State Park (Donaldson Cave System).

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

No species specific management or conservation activities are being conducted concerning Orconectes inermis. Cave and karst habitat located on the Hoosier National Forest are, however, subject to standards and guidelines for caves and karst protection and management as outlined in the Hoosier National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1991). These standards and guidelines include the following:

> *Caves are protected and managed in accordance with the Federal Cave and Karst Resources Protection Act of 1988, Forest Service Manual 2353, Memorandums of Understanding between the forest service and the National Speleological Society, the Indiana Karst Conservancy, Inc., the Forest Cave Management Implementation Plan, and individual specific cave management plans.
>
> *Except where modified by an existing cave management prescription, vegetation within a 150-200 foot radius of cave entrances and infeeder drainages with slopes greater than 30 percent will generally not be cut. No surface disturbing activities will be conducted on any slopes steeper than 30 percent adjacent to cave

entrances. Similar protection areas will be maintained around direct drainage inputs such as sinkholes and swallow holes known to open into a cave's drainage system of any streams flowing into a known cave.

*Allow no sediment from erosion of access roads and drilling sites to wash into caves or karst features.

*Seismic surveys requiring explosives shall not be conducted directly over known cave passages or conduits.

*All caves will be managed as significant.

(USDA Forest Service, 1991)

The forest plan includes a cave and karst management implementation plan. This management plan places an emphasis on cave resource protection and mitigation. Understanding of the caves is established through mapping, bioinventory, cataloging of resources (e.g., archaeological, paleontological, speleothems, etc.), and estimating use levels and trends. Protection zones or other mitigation measures recommended by a management prescription will be established around caves entrances, sinkholes and swallowholes. Specific criteria will include consideration for protection of entrance and cave passage microclimate, animals inhabiting the cave, physical and chemical parameters and aesthetic values associated with the cave.

RESEARCH AND MONITORING

A bioinventory of caves of the Hoosier National Forest documented the presence of Orconectes inermis (Lewis, et al., 2002; and in progress).

RECOMMENDATIONS

Retain on list of Regional Forester Sensitive Species.

REFERENCES

Banta, A.M. 1907. The fauna of Mayfield's Cave. Carnegie Institution of Washington Publications, 67: 1-114.

Cope, E.D. 1871. Wyandotte Cave and its life. The Indianapolis Journal (5 September 1871), page 4.

Cope, E.D. 1872. On the Wyandotte Cave and its fauna. American Naturalist, 6 (7): 406-442.

Elliott, William R. 1998. Conservation of the North American cave and karst biota. Subterranean Biota (Ecosystems of the World). Elsevier Science. Electronic

preprint at www.utexas.edu/depts/tnhc/.www/biospeleology/preprint.htm. 29 pages.

Harvey, S.J. and J. Skeleton. 1968. Hydrogeologic study of a waste-disposal problem in a karst area at Springfield, Missouri. U.S. Geological Survey Professional Paper 600-C: C217-C220.

Hobbs, Jr., H.H. and Thomas C. Barr, Jr. 1972. Origins and affinities of the troglobitic crayfishes of North America (Decapoda: Astacidae) II. Genus Orconectes. Smithsonian Contributions to Zoology, 105: 84 pages.

Hobbs Jr., H.H., H.H. Hobbs III and Margaret A. Daniel. 1977. A review of the troglobitic decapod crustaceans of the Americas. Smithsonian Contributions to Zoology, 244: 183 pages.

Hobbs III, H.H. 1973. The population dynamics of cave crayfishes and their commensal ostracods from southern Indiana. PhD Dissertation, Indiana University, 247 pages.

Jegla, T.C. 1969. Cave crayfish: Annual periods of molting and reproduction. Pages 135-137 in numbers 4-5 in Actes du IV Congres International de Speleologie en Yugoslavie (12-26 IX 1965).

Keith, J.H. 1988. Distribution of Northern cavefish, Amblyopsis spelaea DeKay, in Indiana and Kentucky and recommendations for its protection. Natural Areas Journal, 8 (2): 69-79.

Keith, J.H. and T.L. Poulson. 1981. Broken-back syndrome in Amblyopsis spelaea, Donaldson-Twin Caves, Indiana. Cave Research Foundation 1979 Annual Report, 45-48.

Lewis, Julian J. 1993. Life returns to Hidden River Cave: The rebirth of a destroyed cave system. National Speleological Society News, (June) 208-213.

Lewis, Julian J. 1996. The devastation and recovery of caves affected by industrialization. Proceedings of the 1995 National Cave Management Symposium, October 25-28, 1995, Spring Mill State Park, Indiana: 214-227.

Lewis, Julian J. and Thomas P. Sollman. 1998. Groundwater monitoring in significant aquatic caves that lie beneath impending residential developments in the Blue River Basin of southern Indiana. Final report, Ohio River Valley Ecosystem, U.S. Fish & Wildlife Service, 89 pages.

Lewis, Julian J., Ronnie Burns and Salisa Rafail. 2002. The subterranean fauna of the Hoosier National Forest. Unpublished report, 115 pages.

Packard, A.S. 1888. The cave fauna of North America, with remarks on the anatomy of the brain and origin of the blind species. Memoirs of the National Academy of Sciences, 4: 1-156.

Panno, S. V., I.G. Krapac, C.P. Weibel and J.D. Bade. 1996. Groundwater contamination in karst terrain of southwestern Illinois. Illinois Environmental Geology Series EG 151, Illinois State Geological Survey, 43 pages.

Panno, S.V., C.P. Weibel, I.G. Krapac and E.C. Storment. 1997. Bacterial contamination of groundwater from private septic systems in Illinois' sinkhole plain: regulatory considerations. Pages 443-447 In B.F. Beck and J.B. Stephenson (eds.). The engineering geology and hydrology of karst terranes. Proceedings of the sixth multidisciplinary conference on sinkholes and the engineering and environmental impacts on karst. Spring, Missouri.

Panno., S.V., W.R. Kelly, C.P. Weibel, I.G. Krapac, and S.L. Sargent. 1998. The effects of land use on water quality and agrichemical loading in the Fogelpole Cave groundwater basin, southwestern Illinois. Proceedings of the Illinois Groundwater Consortium Eighth Annual Conference, Research on agriculture chemicals in Illinois groundwater, 215-233.

Peck, Stewart B. 1969. Spent carbide – a poison to cave fauna. NSS Bulletin, 31(2): 53-54.

Quinlan, J.F. and D.R. Rowe. 1977. Hydrology and water quality in the central Kentucky karst. University of Kentucky Water Resources Research Institute, Research Report 101, 93 pages.

Quinlan, J.F. and D.R. Rowe. 1978. Hydrology and water quality in the central Kentucky karst: Phase II, Part A. Preliminary summary of the hydrogeology of the Mill Hole sub-basin of the Turnhole Spring groundwater basin. University of Kentucky Water Resources Research Institute, Research Report 109, 42 pages.

USDA Forest Service. 1991. Land and Resource Management Plan Amendment for the Hoosier National Forest.

USDA Forest Service. 2000. Land and Resource Management Plan, Amendment No. 5, for the Hoosier National Forest.